

CITY OF FORT WORTH, TEXAS

STUDY OF

SOUTHEAST LANDFILL SITE

TXD 980 623557

1982

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FREESE AND NICHOLS, INC.

CONSULTING ENGINEERS

FORT WORTH, TEXAS

STUDY OF  
SOUTHEAST LANDFILL SITE

FEBRUARY 1982  
PHASE II REPORT

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FORT WORTH, TEXAS  
STUDY OF SOUTHEAST LANDFILL

1. INTRODUCTION

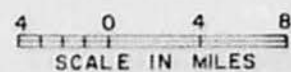
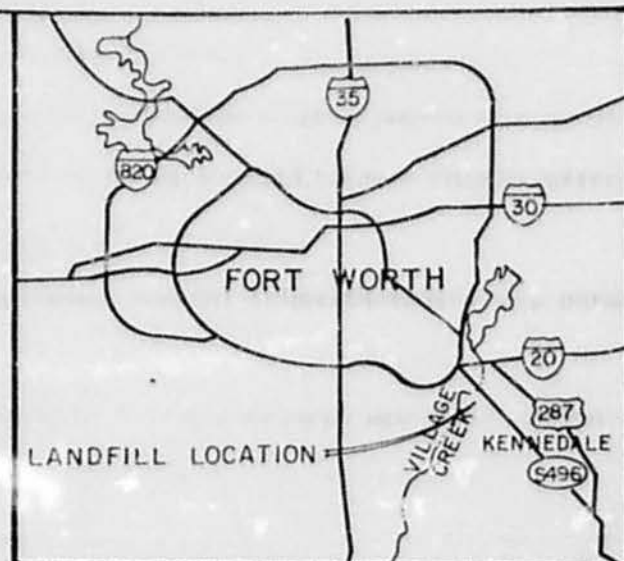
The Southeast Landfill is located in the southeast part of Fort Worth near the City of Kennedale. This landfill is composed of 265 acres immediately upstream from the Southern Pacific Railroad on Village Creek. The section of the landfill located east of Village Creek contains 189 acres and has been used to dispose of some five million cubic yards of trash. The area west of Village Creek will probably not be used as a landfill because of access and utility easement conflicts. Figure 1.1 is a location and vicinity map.

The landfill was originally opened in 1967 and has been used by other local municipalities and the general public as well as the City of Fort Worth. Landfill operations began in the southwest corner of the tract behind a levee that forms the west side of the landfill beginning in the southwest corner. At present, this levee extends about one-half way along the south property line of the tract. Sanitary waste has been placed between the levee and the natural bank running along the east side of the landfill. Figure 1.1 shows the location of the levee.

The levee and a portion of the landfill are located within the Village Creek 100-year flood plain as determined by the Corps of Engineers (1). Therefore, the levee not only serves as a barrier to the landfill but also to prevent flooding of the landfill. During floods,

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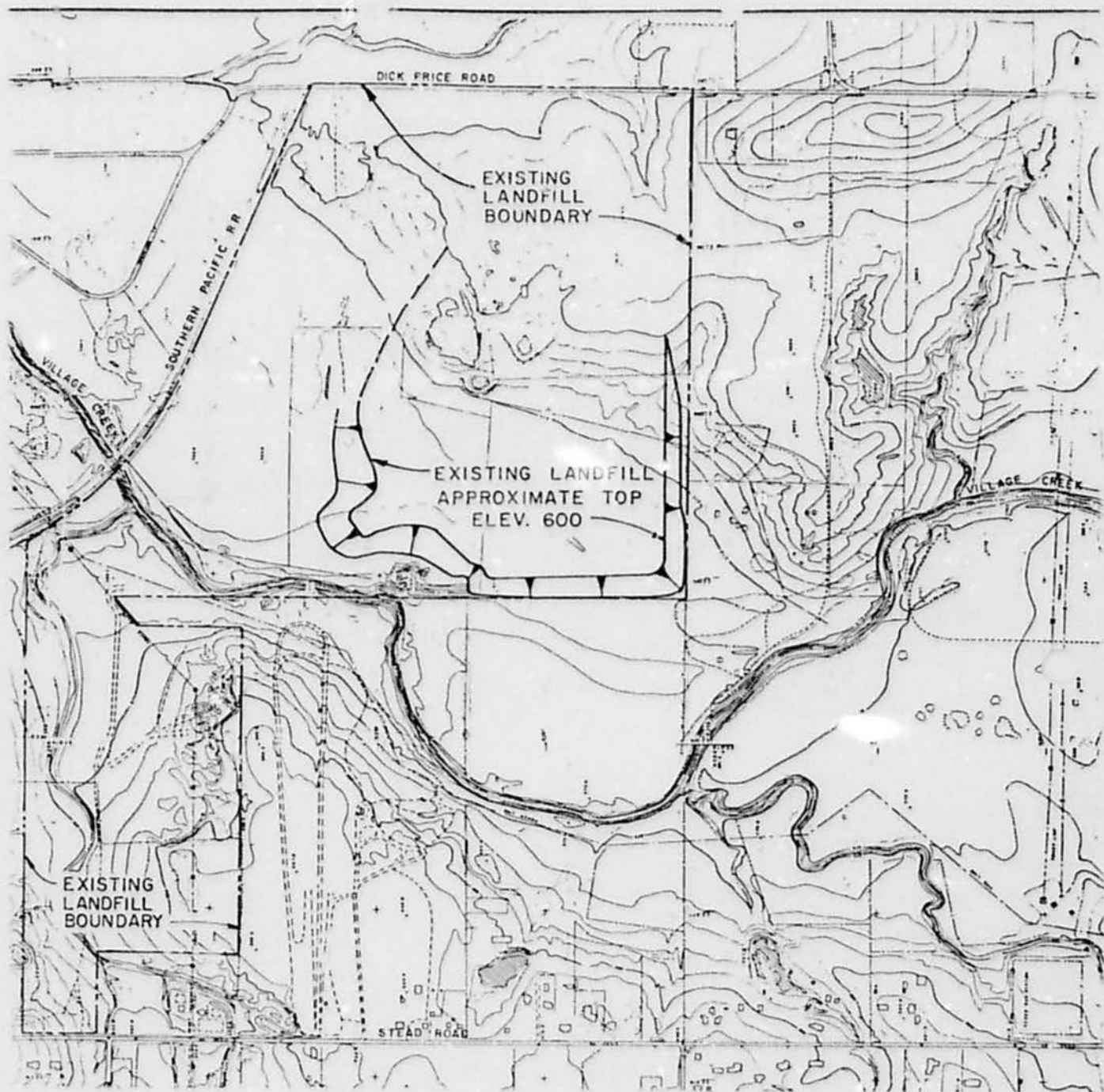
(1)Numbers in parenthesis match references listed in "List of References"



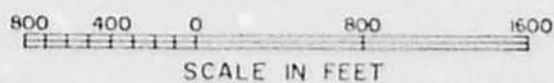
VICINITY MAP



FIGURE I.I



### LOCATION MAP





the levee must prevent the sanitary waste from washing downstream but in doing so the levees block part of the flow area affecting upstream water levels. Therefore, the levee potentially could have adverse effects both upstream and downstream of the landfill.

In 1980, the Texas Department of Public Health rejected a permit application that would have allowed use of the Southeast Landfill through 1986. The reason for rejecting the request was the location in the Village Creek flood plain. The Texas Department of Water Resources has also determined that the levees surrounding the landfill come under the purview of the Texas Water Code and must be approved by that agency. In January of 1981, the Southeast Landfill was included in the Open Dump Inventory listing in the Federal Register. Listing in this category may subject the City of Fort Worth to legal action by state agencies to cease operations.

In February of 1981, the City of Fort Worth contracted with Freese and Nichols, Inc., to study the following:

1. Selection of the best alternate to satisfy the requirements of regulatory agencies concerning the encroachment into the Village Creek flood plain.
2. The current operation of the landfill and potential for future development.

Based on the results of this initial study and meetings with the Texas Department of Health and Texas Department of Water Resources, further studies were authorized in September 1981 to:

1. Clarify subsurface conditions discovered in the initial study.
2. Study the possibility of landfill expansion on adjacent prop-

erty not then owned by the City.

Two separate analyses were required for the studies; a hydraulic analysis to determine the flow conditions in Village Creek, and a geotechnical analysis to determine the subsurface conditions and stability of earthen structures. Present condition of the landfill and alternate solutions to existing problems were determined by utilizing information from these two studies. This report describes the analyses, results, and conclusions.



## 2. HYDRAULIC ANALYSIS

A basic element of this study was the development of a computerized model of Village Creek and the Southeast Landfill levees. The model was developed from topography and physical features of the area and resistance to flow within the area. Utilization of the HEC-2 computer program (2) for a prescribed flood flow amount furnished a determination of water levels and flow velocities. The model was then modified to study water levels and flow velocities before the landfill was constructed and after construction of possible alternatives.

Cross sections of the Village Creek channel and flood plain areas in the vicinity of the landfill were surveyed by the City of Fort Worth. The surveyed cross section data was supplemented by information obtained from topographic maps with a scale of 1" = 400' and 5-foot contour intervals. Topographic maps were furnished by the City of Fort Worth. Resistance to flow was determined from field observations of the area. Conditions prior to the landfill construction were also obtained from mapping furnished by the City.

Flood control structures such as the landfill levees are designed for the flood flow amount resulting from a 100-year flood, a flood with a one percent probability of occurrence in any given year. On the average it will occur once every 100 years; however, the flood could occur more than once in any one year or in successive years. The 100-year flood flow used in this analysis was obtained from recent unpublished studies by the Fort Worth District, U.S. Army Corps of Engineers. These studies were performed as a technical service for the City of Fort Worth by the Corps and reflect recent urbanization trends

on the Village Creek watershed. The Corps also furnished results of a water surface profile study. The computer models developed for that study were used as the basis for the analysis discussed in the previous paragraphs. However, several modifications were required. Results of the analyses are given in Section 4 of this report.

### 3. GEOTECHNICAL ANALYSIS

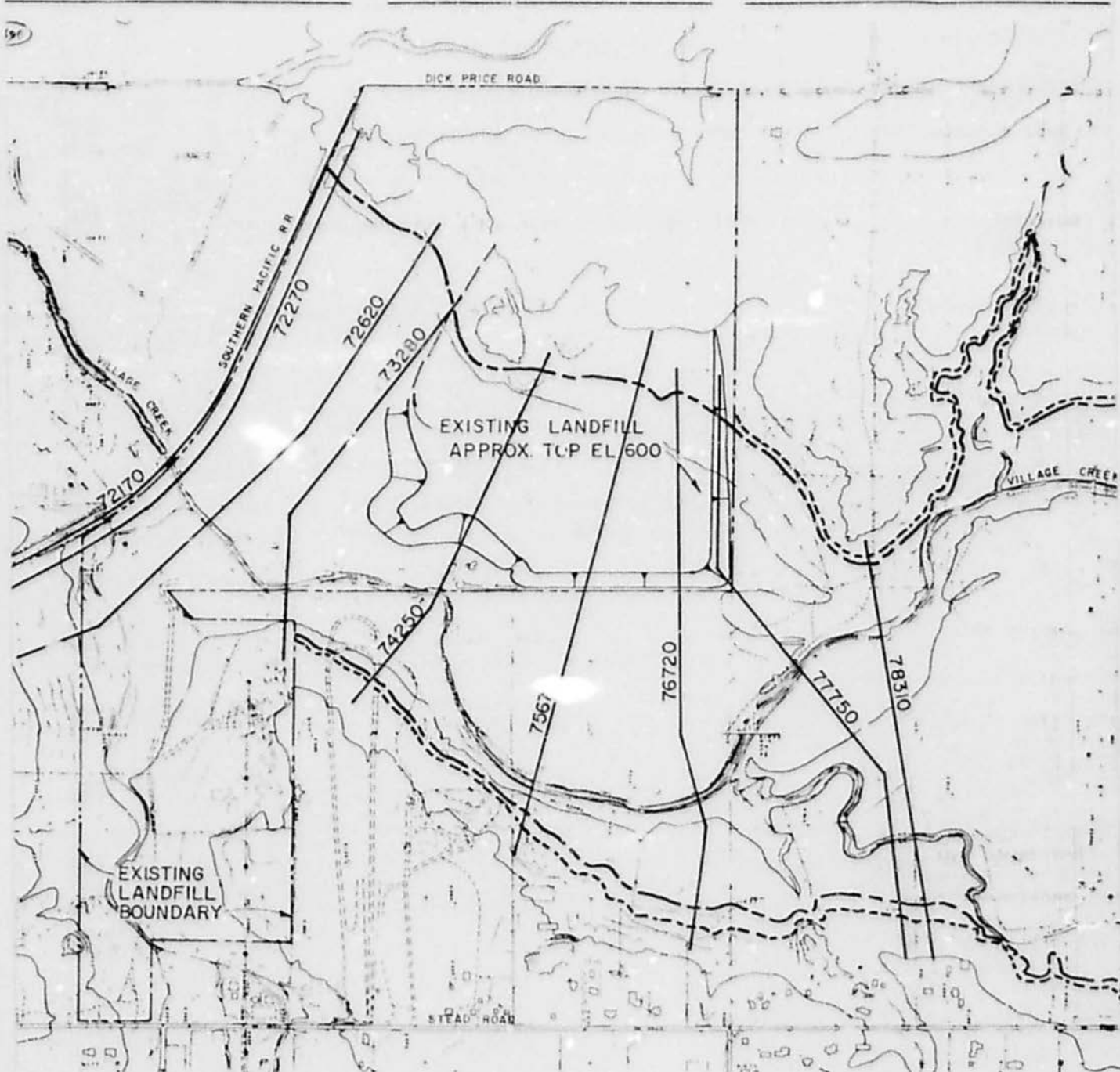
A geotechnical analysis to evaluate the stability of the present levee system and make recommendations for future levee construction and landfill expansion was made by Rone Engineers, Inc. The analysis included borings and tests on the material recovered from the borings to determine subsurface conditions. Further description of their analysis are contained in separate reports entitled "Geotechnical Investigation, City of Fort Worth Southeast Landfill," and "Geotechnical Investigation, Landfill Extension, City of Fort Worth Southeast Landfill." Results of their analysis are given in Section 4 and 5 of this report.

#### 4. EVALUATIONS OF PRESENT CONDITIONS

The 100-year flood water levels in Village Creek are as much as 4.6 feet higher today than they were prior to the landfill construction. Table 4.1 gives a tabulation of the change in water level across the site and Figure 4.1 shows the effect of the higher water levels. The reason for increased water levels is the blocking of a significant part of the original Village Creek flow area by the landfill levee. The result is that an additional 16 acres of land not owned by the City of Fort Worth will now be submerged by the 100-year flood. In addition, blocking a part of the flow area has significantly increased the velocity of flow thereby creating the possibility of erosion damage on both City of Fort Worth owned and adjacent property.

The geotechnical investigation revealed that the existing landfill levee was stable, but that water may be migrating from the landfill. It appears that water is migrating under the levee through pervious soil formations that are below the natural ground surface and above the impervious rock/shale stratas underlying the entire site. Tests performed on samples of groundwater outside the levee reveal that several of the parameters tested exceeded secondary water quality standards. The top of the rock/shale generally dips north and west (towards Village Creek). Therefore, although not specifically studied, it is assumed that the groundwater eventually flows into Village Creek.

In order to meet the requirements of the Texas Department of Water Resources it will be necessary to lower the 100-year flood water level to within one foot of the level prior to construction of the landfill levees or obtain flood easements on the land that will be flooded due

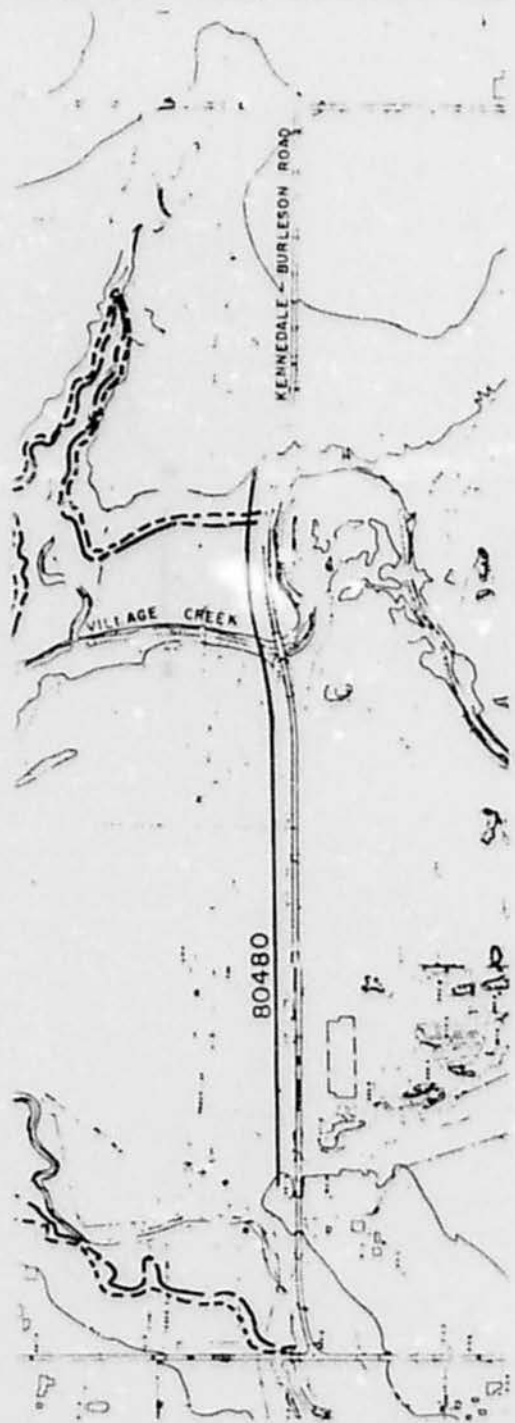


FLOOD LIMITS



SCALE IN FEET





## LEGEND

- 100 YR. FLOOD W.L. BEFORE LANDFILL
- - - - 100 YR. FLOOD W.L. AFTER LANDFILL
- 78310 CITY OF FORT WORTH CROSS SECTIONS



FIGURE 4.1



## 5. EVALUATION OF FUTURE LANDFILL OPERATIONS

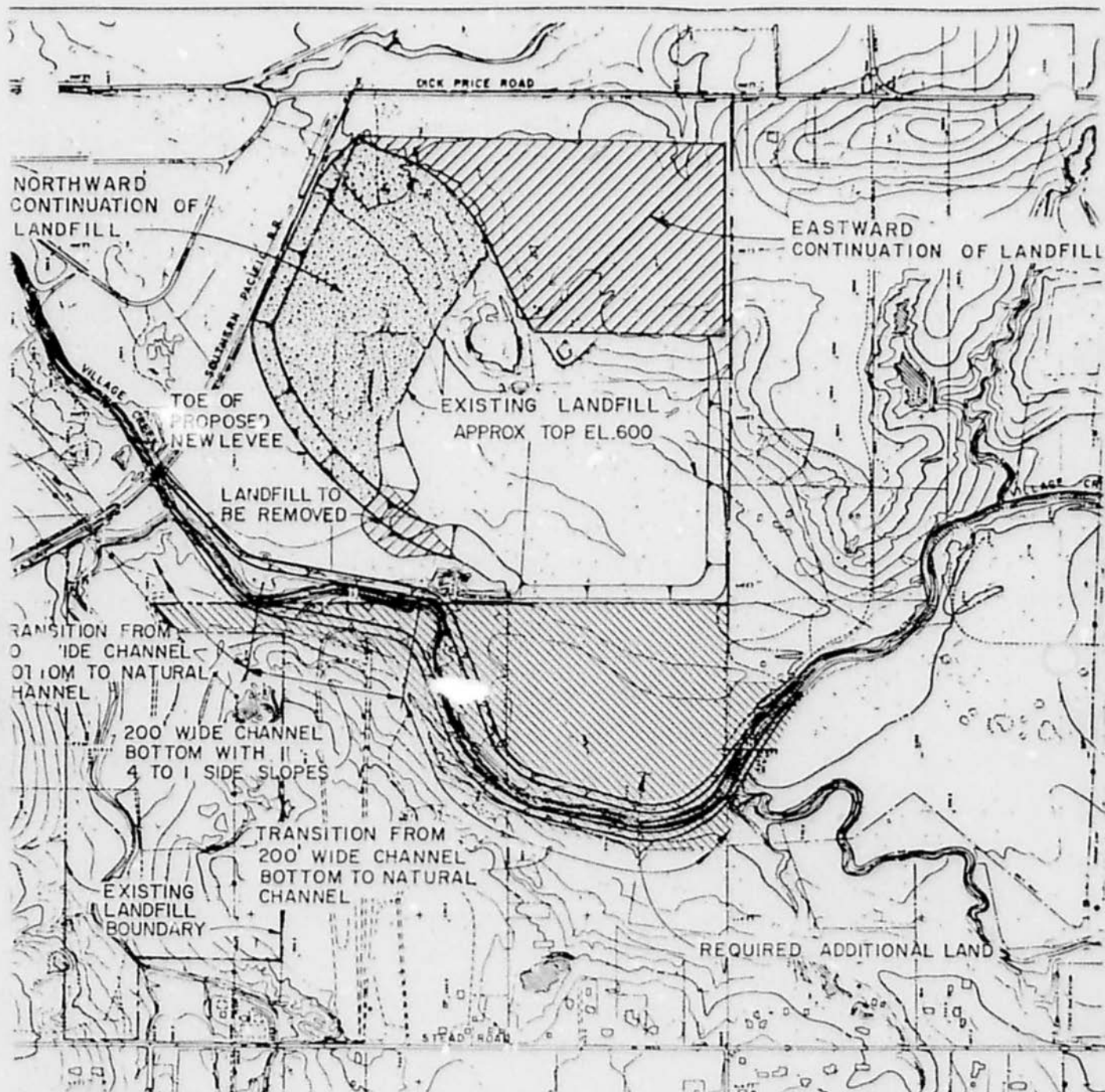
To meet the requirements of the Texas Department of Health and Texas Department of Water Resources, the effect of the Southeast Landfill on the Village Creek 100-year flood water level outside Fort Worth owned property will have to be reduced and the migration of water from the landfill will have to be prevented. Once these regulatory requirements are met, the landfill could be removed from the Open Dump Inventory. The alternatives in the following sections outline procedures that are possible in addition to satisfying the regulatory requirement.

### Continuations With Present Permit

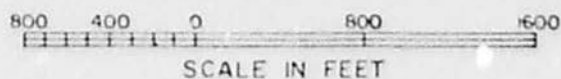
The City of Fort Worth is planning to continue the present landfill to the north toward the Southern Pacific Railroad and to the east toward Dick Price Road to meet immediate landfill needs. However, the 100-year flood water levels on Village Creek would have to be lowered and the migration of water from the landfill would have to be stopped so that regulatory requirements will not force the closing of the landfill.

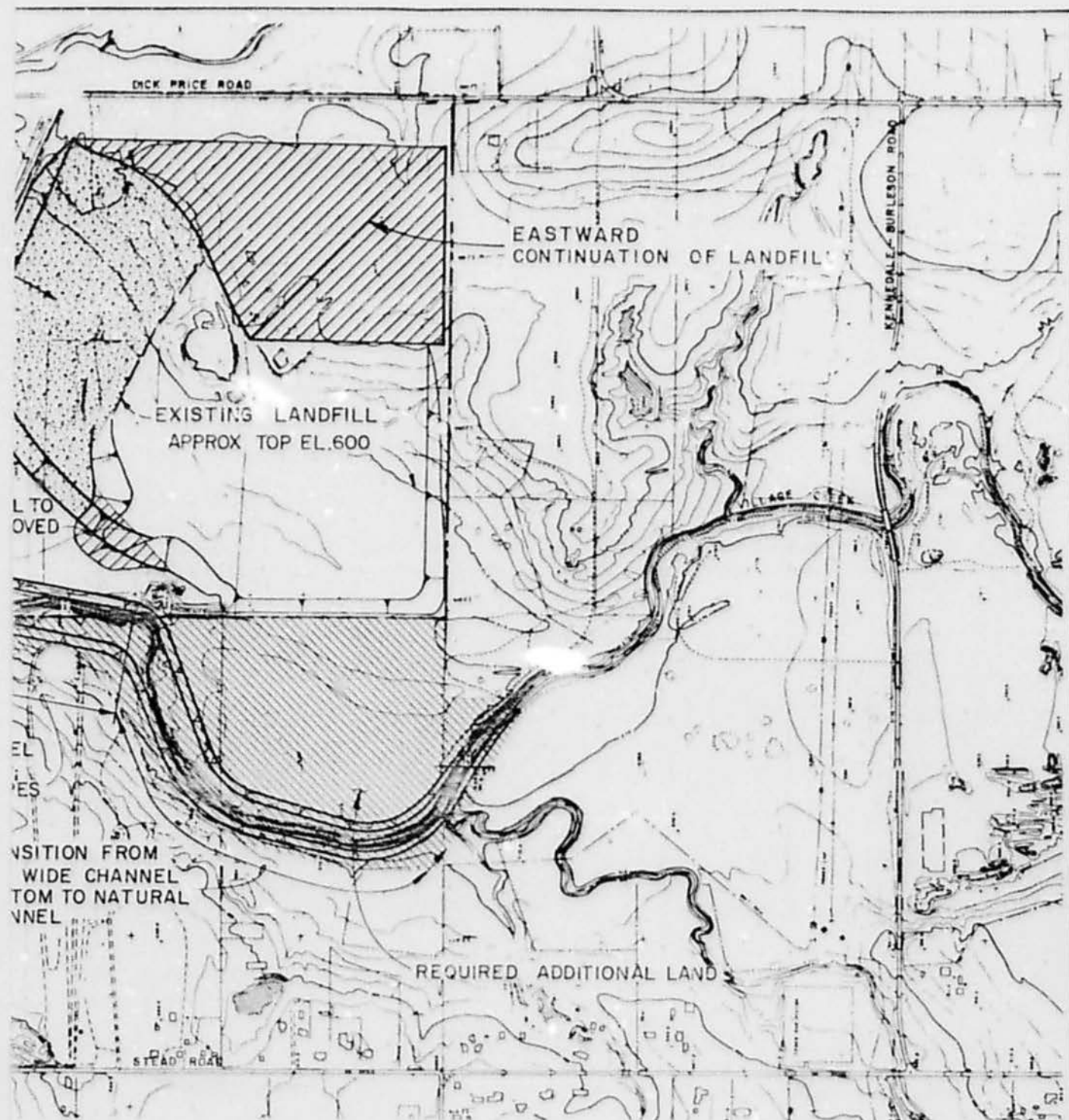
The eastward continuation will be in an area out of the Village Creek flood plain and will be a cut and cover operation. The area will be excavated to rock or shale and landfill placed. The excavated material will be used for cover and other miscellaneous operations.

The northward continuation will be in the Village Creek flood plain. Levees would need to be constructed as shown on Figure 5.1. The areas east and south of the levees could be used as landfill. The 100-year flood water levels can be lowered to acceptable limits by excavating a wider channel for Village Creek. Table 5.1 gives a tabulation of the water levels and flow velocities across the site with



# CONTINUATION OF LANDFILL WITH PRESENT PERMIT





CONTINUATION OF LANDFILL WITH PRESENT PERMIT

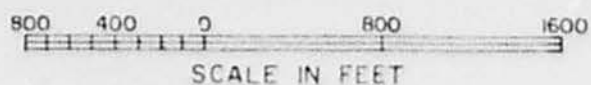


FIGURE 5.1

Table 5.1

100-Year Flood Water Levels and Velocities  
With Landfill Continuities and Expansions

Station	Elevation of 100-Year Water Level				
	Prior to Landfill	Northward Continuation*		Expansion to South*	
72160	576.3	576.4	(+0.1)**	576.4	(+0.1)
72180	577.5	578.2	(+0.7)	578.2	(+0.7)
72270	578.4	579.1	(+0.7)	579.1	(+0.7)
72620	578.6	579.5	(+0.9)	579.5	(+0.9)
73280	578.8	579.5	(+0.7)	579.5	(+0.7)
74250	580.3	579.9	(-0.4)	579.9	(-0.4)
75670	581.8	581.4	(-0.4)	581.4	(-0.4)
76720	582.5	582.5	(+0.0)	582.3	(-0.2)
77750	583.3	583.6	(+0.3)	583.8	(+0.5)
78310	584.8	584.8	(+0.0)	585.7	(+0.9)
80480	589.1	589.1	(+0.0)	589.2	(+0.1)

\*Includes equivalent encroachment loss in flood plain west of Village Creek, and construction of improved channel.

\*\*Number in parenthesis is difference between water level for that condition and water level prior to landfill.

Station	Velocities in Feet Per Second		
	Prior to Landfill	Northward Continuation	Expansion to South
72160	7.9/14.9/8.9*	8.6/16.4/10.4	8.6/16.4/10.4
72180	5.5/10.4/7.2	6.0/10.8/ 8.5	6.0/10.8/ 8.5
72270	2.9/ 7.6/2.5	2.7/ 7.6/ 2.1	2.7/ 7.6/ 2.1
72620	1.8/ 5.0/1.8	1.7/ 5.9/ 2.0	1.7/ 5.9/ 2.0
73280	3.3/ 9.6/3.3	0/ 8.2/ 2.1	0/ 8.2/ 2.1
74250	4.1/ 9.3/3.4	0/ 9.4/ 1.7	0/ 9.4/ 1.7
75670	2.5/ 6.4/2.6	0/ 9.2/ 2.4	0/ 9.4/ 3.6
76720	2.0/ 6.4/3.0	0/ 9.3/ 3.1	0/10.4/ 3.6
77750	3.8/11.1/4.9	3.5/12.8/ 4.4	4.2/15.3/ 5.3
78310	4.7/12.4/4.4	4.5/15.1/ 4.1	4.1/13.3/ 3.8
80480	3.0/ 7.0/1.9	2.8/ 8.4/ 1.8	2.8/ 8.4/ 1.8

\*Velocities in left overbank/channel/right overbank looking downstream.

channelization. The location of the channel is shown in Figure 5.1 and a typical cross section of the channel is shown in Figure 5.2. The channelization is favored over the flood easements because the excavated material could be used to construct the additional levees and the



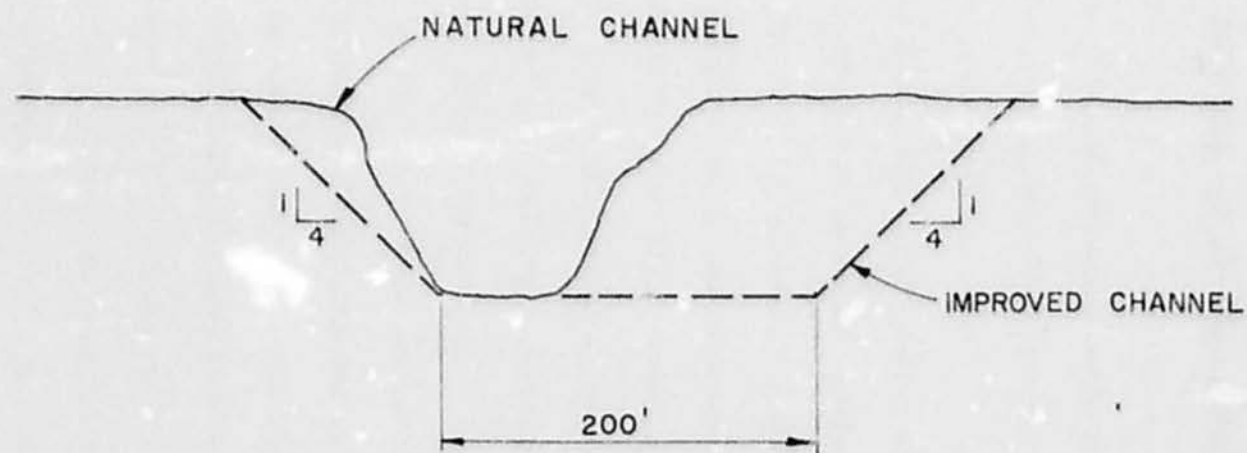


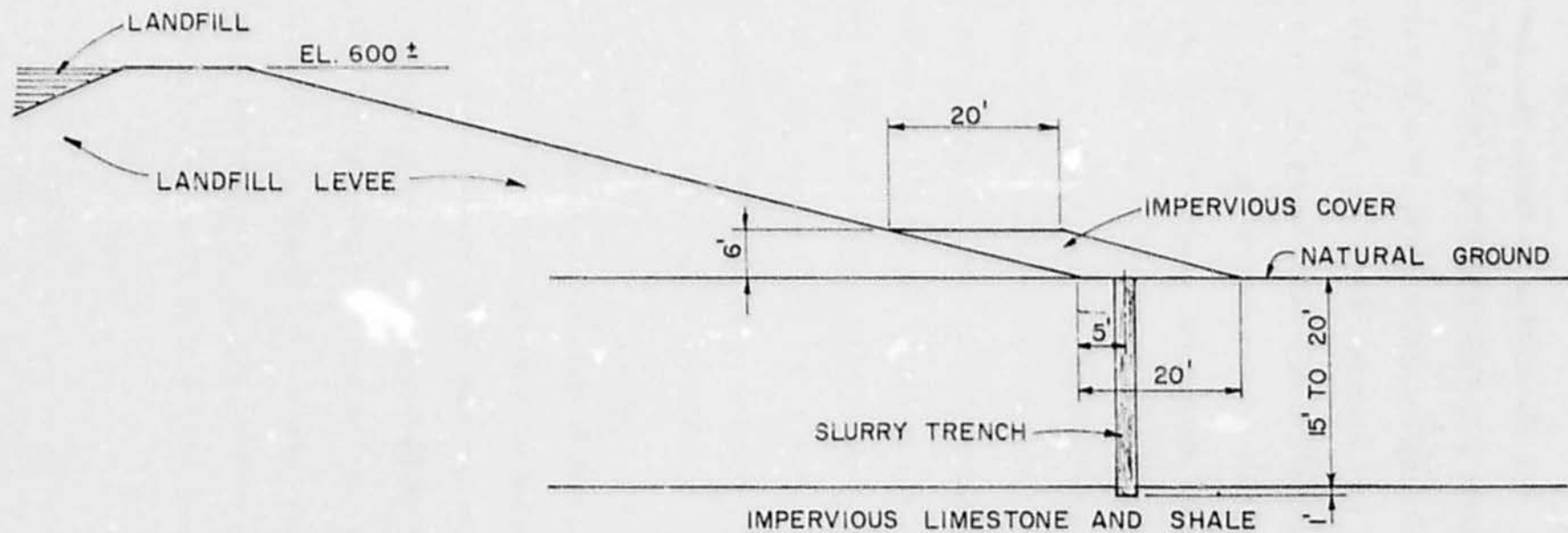
FIGURE 5.2

velocities during flood flows would be reduced to near the same as natural conditions. Approximately 65,000 cubic yards of landfill and cover would have to be moved to improve the flow conditions at the north end of the present levees. In addition, the area between the levees and Village Creek would have to be graded to approximately the original topography.

Migration of water from the landfill would need to be stopped by a barrier through natural pervious subsurface material and tied into the levees. The least costly barrier would be a soil-bentonite slurry trench around the entire site. The trench would be constructed as shown in Figure 5.3 along the existing levees bounding the south and west sides of the lands. It would be constructed under the new west and north levees tying into the levee's impervious zones. Along the east side, the slurry trench would be constructed from natural ground to the subsurface impervious stratas. The reason for the slurry trench on this side is not to prevent migration of groundwater (because the impervious rock/shale dip up along the east side), but would be used instead of plating all excavations with impervious material as required by regulatory agencies to prevent localized leaching. The plating is very time consuming with little assurance of always obtaining a good barrier.

If the required channel excavation does not include adequate sources of impervious material, the impervious zone can be constructed using other site borrow sources such as the required excavation for the eastward continuation. The excess excavation can be used for daily fill requirements and other miscellaneous landfill uses. All levees will need to have a cover of vegetation established.



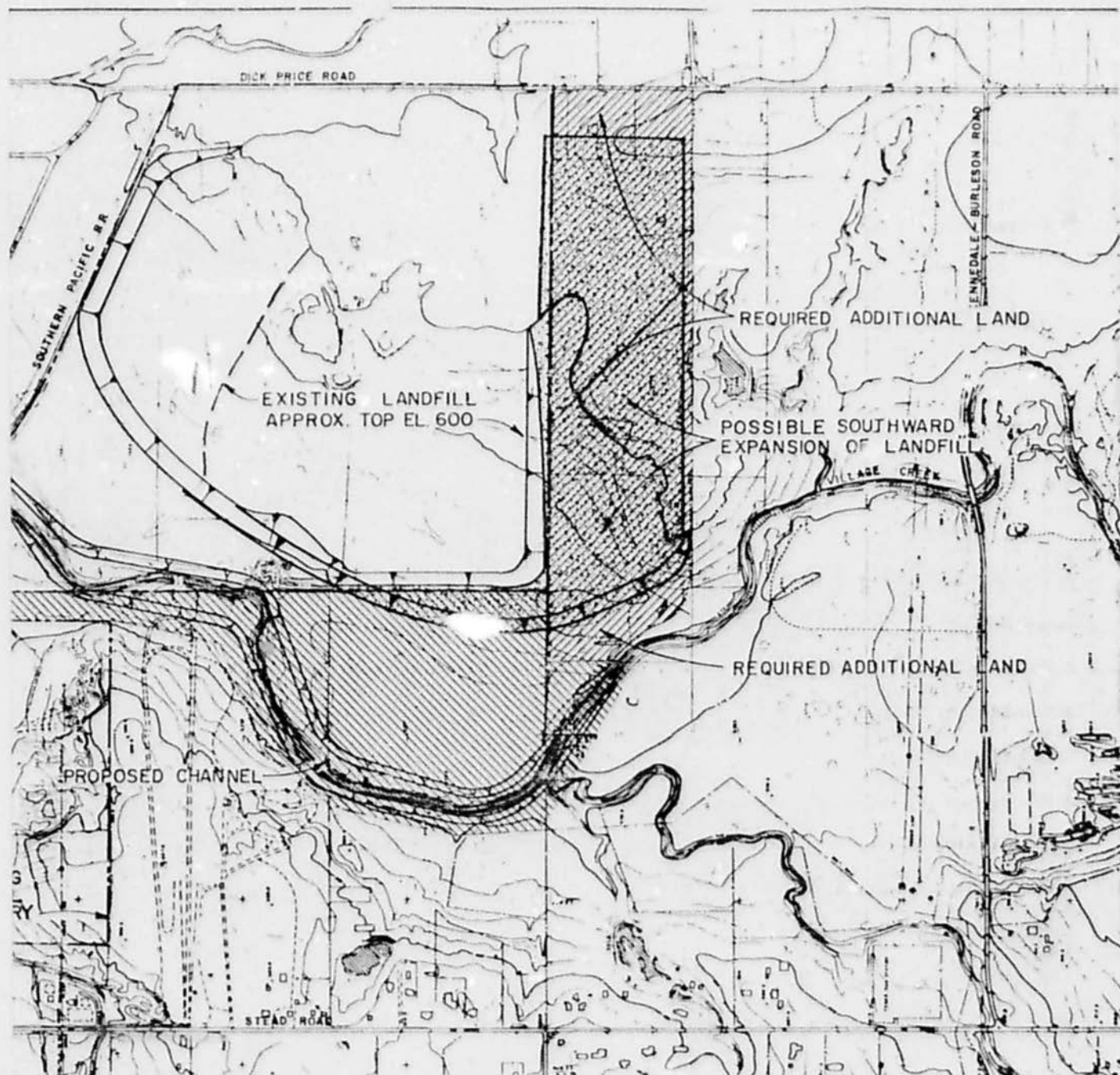


### SLURRY TRENCH BARRIER

FIGURE 5.3

A benefit of this alternative is that some 2.1 million cubic yards of additional landfill volume could be obtained from the northward expansion and 2.1 million cubic yards from the eastward expansion. Using conversions furnished by the City of Fort Worth, this would allow almost 10 years of additional usage based on the historical rates of dumping, which includes dumping open to the public. If only the City of Fort Worth Municipal Departments use the landfill, 24 years of additional usage would be available. This estimate of additional volume assumes complete utilization of the areas within the landfill. A secondary benefit is that the channelization decreases the velocities in the channel and flood plain to almost the same as natural conditions so possible erosional damage during floods would be reduced.

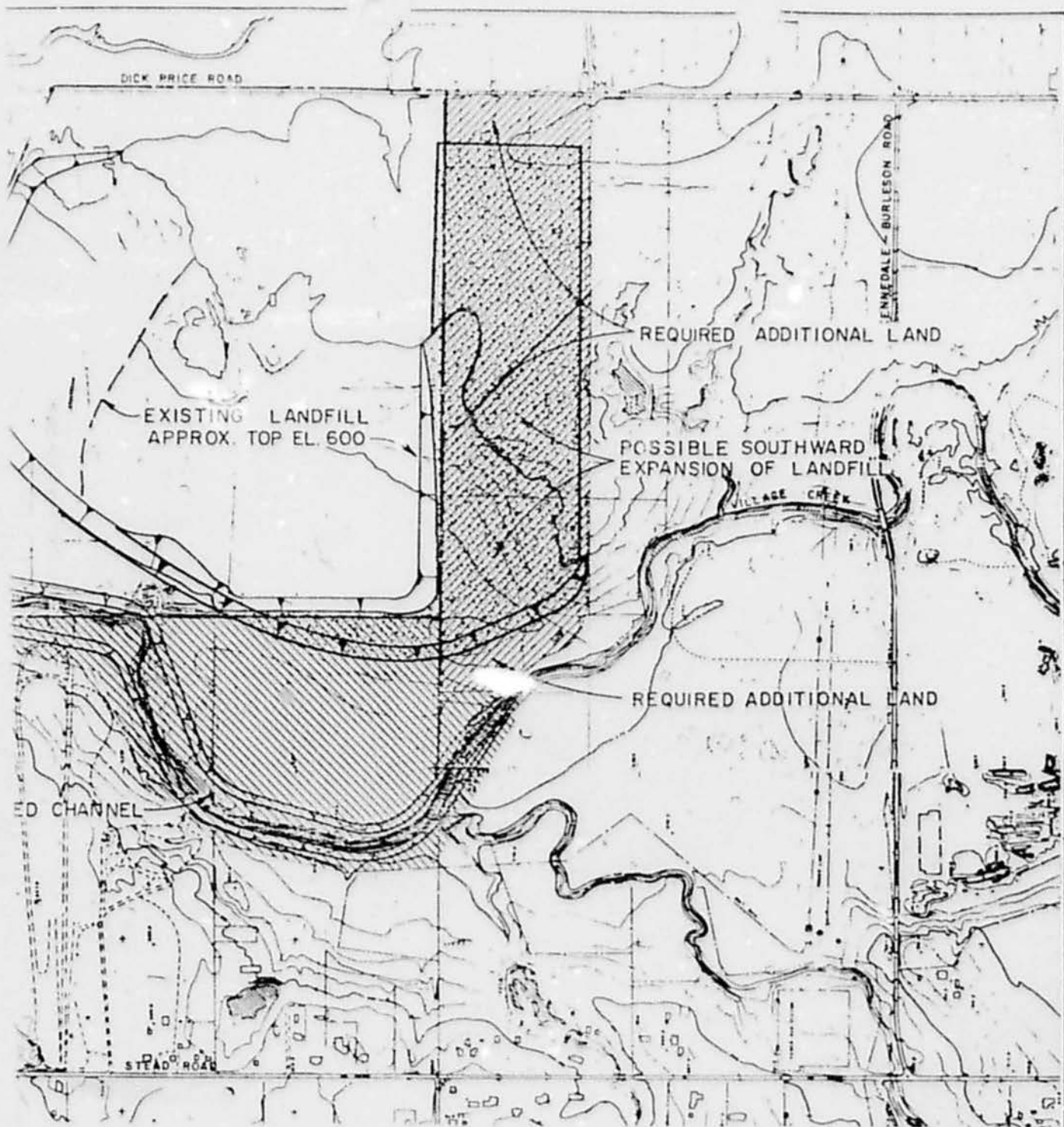
The cost of continuation to the north and east is \$2,677,000 and is tabulated in Table 5.2. Not included in the cost is obtaining the necessary permits from the Texas Department of Water Resources. The results summarized in this report will be adequate for the necessary engineering data to accompany the permit application. The estimated costs for continuation to the north and east is \$268,000 per year using the historical rates of dumping, which includes dumping open to the public and \$112,000 per year if the landfill is used only by the City of Fort Worth Municipal Departments. Figure 5.1 shows the acquisition of land in excess of that needed for channelization. This additional land would be needed for construction easements, for control of its use and as a source of borrow materials. If necessary, the limits could be reduced as required but the size of the channel could not be changed.



**FUTURE EXPANSION WITH PERMIT AMENDMENTS**



FIGURE 5.4



# FUTURE EXPANSION WITH PERMIT AMENDMENTS

800 400 0 800 1600  
SCALE IN FEET



FIGURE 5.4

Table 5.2

Estimate of Costs for Continuation with Present Permit

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Slurry Trench	S.F.	230,000	\$ 2.50	\$ 575,000
Excavation of Channel	C.Y.	477,000	1.00	477,000
Embankment	C.Y.	347,000	1.00	347,000
Stockpile Excess Exc.	C.Y.	77,000	.75	58,000
Moving Landfill	C.Y.	- 65,000	3.00	195,000
Top Soil and Seeding	Acre	15	2,000.00	30,000
Engineering and Contingencies @ 30%				505,000
Subtotal for Construction				\$2,187,000
Land for Channel	Acre	68	6,000.00	408,000
Administration and Contingencies @ 20%				82,000
Subtotal for Land				\$ 490,000
TOTAL				\$2,677,000

Future Expansion With Permit Amendments

Possible future landfill expansions include a southward expansion of the landfill on property not owned by the City of Fort Worth and a second layer of landfill on top of the existing landfill. The second layer of landfill could be constructed on top of the existing landfill some 100 to 200 feet inside of the existing landfill levee or edges. The area within these secondary levees would then be used for landfill. Permission for such an expansion can usually be obtained from the Texas Department of Health as an administrative change to the existing permit. A new site development plan, concept of operation and closure plan would have to be furnished. This expansion does not appear feasible because the considerable quantity of earth fill to build levees and ramps is not available. Therefore, no cost estimates have been made. If, in the future, it appears that excess earthen material would be available, the



City of Fort Worth should consider a second layer of landfill.

To expand to the south, levees would have to be constructed as located on Figure 5.4. The areas east and north of the levees could be used for landfill. This expansion would be in addition to the landfill continuation previously described. With the channelization, construction of the southern levees to reclaim a portion of the flood plain, would have no significant effect on the 100-year flood water levels. Table 5.1 gives a tabulation of the water levels and flow velocities with southward expansion. A permit would have to be obtained from the Texas Department of Water Resources for the additional levees and from the Texas Department of Health for the landfill expansion. The results summarized by this report will be adequate for the necessary engineering data to accompany the permit application to the Texas Department of Water Resources. The Texas Department of Health would probably require an amendment to the existing Southeast Landfill permit. This amendment would include an operation plan, environmental assessment and public hearing.

As previously described, a slurry trench would have to be constructed under the new levees and around the remainder of the landfill. If the slurry trench along the south side of the southward expansion were constructed at the same time as the slurry trench around the remainder of the landfill, a slurry trench would not be required along the south side of the existing landfill, resulting in construction cost savings. The material for the levee construction can be obtained from the required channel excavation and other borrow sources on the site. The proposed additional landfill area to the south appears favorable



based on a geotechnical analysis of the area.

The principal benefit of this alternative is the estimated additional 2.7 million cubic yards of landfill volume obtained assuming complete utilization of the area. Using conversions furnished by the City of Fort Worth, the southward expansion would increase the landfill usage by an additional 6 years based on historical rates of dumping, which includes dumping open to the public, and by 15 years if usage is limited to City of Fort Worth Municipal Departments.

The cost of expanding to the south, assuming the construction would be done simultaneously with the construction for the northward and eastward continuations, is \$701,000 and is tabulated in Table 5.3. Not

Table 5.3

Estimate of Costs for Southward Expansion

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Slurry Trench	S.F.	240,000	\$ 2.50	\$ 600,000
Excavation of Channel	C.Y.	477,000	1.00	477,000
Unclassified Excavation	C.Y.	69,000	1.00	69,000
Embankment	C.Y.	474,000	1.00	474,000
Removing Landfill	C.Y.	65,000	3.00	195,000
Top Soil and Seeding	Acre	15	2,000.00	30,000
Engineering and Contingencies @ 30%				554,000
Subtotal for Construction				\$2,399,000
Land for Channel	Acre	68	6,000.00	408,000
Land for Expansion	Acre	68	6,000.00	408,000
Administration and Contingencies @ 20%				163,000
Subtotal for Land				\$ 979,000
Total for Expansion to South and Continuations with Present Permit				\$3,378,000
Total for Continuation with Present Permit				2,677,000
TOTAL FOR SOUTHWARD EXPANSION				\$ 701,000

\*Cost Estimate is for Continuation to North and Expansion to South as a single construction project.

included in the cost are the necessary permits. The estimated costs for this expansion are \$117,00 per year using historical rates of dumping, which includes dumping open to the public, and \$47,000 per year if the landfill is used only by the City of Fort Worth Municipal Departments. If the southward expansion were done after the northward and eastward continuation construction, the estimated cost would be about \$1 million.

#### Closure of Landfill

Although it is not considered an option at this time, the possibility of closing the landfill was studied. If closed, the migration of groundwater from the landfill will still have to be stopped and some action on the increased Village Creek flood levels caused by the landfill levees will have to be made to satisfy regulatory requirements. The simplest solution to the increased flood levels would be purchase of flood easements on the affected land. As previously discussed, the levees and surrounding property could still be subject to erosion damage at the locations where the levees constrict the flood plain. After the flood easements are obtained, it would be necessary to submit a permit application for the levees to the Texas Department of Water Resources.

Migration of water from the landfill would have to be stopped by a barrier through natural pervious subsurface material and tied into the levees. The least costly cutoff method is a soil-bentonite slurry trench constructed as shown in Figure 5.3. This slurry trench would have to be constructed around three sides of the site. To tie the slurry wall to the levee, an impervious cover would have to be placed over the slurry trench as shown in Figure 5.3. This cover would be more extensive along the north side of the landfill to protect the abandoned

fill. At places along the west and south sides, the impervious cover would fill the entire area between the existing toe of levee and the property line so additional construction easements could be required.

After the slurry wall and its impervious cover were completed, the levee slopes would have to be dressed with topsoil and a grass cover established. The top of the landfill would also require a minimum two foot cover over all trash. Most of the landfill presently meets this requirement, but some areas would need additional cover or removal of deleterious materials near the surface. Finally, the entire landfill would have to be plated with topsoil and vegetation established.

The cost of closing the landfill is estimated to be \$1,175,000 as shown in Table 5.4. This does not include costs for securing permits from the Texas Department of Health and Texas Department of Water Resources. The principal benefit of this action is that it is the least costly alternative. The negative aspect is that it will take the landfill out of service and the increased velocities of the flood flows may cause erosion damage that would have to be repaired in the future.

Table 5.4

Estimated Costs for Closure of Landfill

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
Slurry Trench	S.F.	134,000	\$ 2.50	\$ 335,000
Impervious Cover	C.Y.	120,000	2.00	240,000
Misc. Grading and Dressing	L.S.			100,000
Top Soil and Seeding	Acre	100	2,000.00	200,000
Engineering and Contingenices @ 30%	-			<u>262,000</u>
Subtotal for Construction				\$1,137,000
Flood Easement	Acre	16	2,000.00	32,000
Administration and Contingencies @ 20%				<u>6,000</u>
Subtotal for Easement				\$ 38,000
TOTAL				\$1,175,000

## 6. CONCLUSION

The Southeast Landfill has two significant problems which should be corrected. First, the existing levees cause the Village Creek 100-year flood level to be as much as 4.6 feet higher than the water level prior to the landfill construction. The water levels should be lowered or an easement obtained from landowners affected by the higher water levels. Second, water not meeting secondary water quality standards is migrating from the landfill. This seepage should be stopped.

Briefly summarized, the possibilities for future landfill operations while solving these problems are:

### 1. Continuations With Present Permit

- a. Summary. Expand existing levees to the north, excavate a 200 foot wide channel for Village Creek, and construct a slurry trench to prevent water migration. Planned continuation of landfill within levees and east of existing landfills would not be affected.
- b. Cost. \$2,677,000 (not including permit application) \$268,000 per year of landfill life using historical rates of dumping, which includes dumping open to the public. \$112,000 per year of landfill life if use limited to City of Fort Worth Municipal Departments.
- c. Benefit. Usable life of existing landfill is 10 years using historical dumping rates, which includes dumping open to the public, and 24 years if dumping is limited to City of Fort Worth Municipal Departments.

## 2. Future Expansions With Permit Amendments

- a. Summary. Additional landfill expansion, to the south on property not now owned by the city, is possible. The levees would have to be expanded to the south and somewhat westward. The channelization and slurry trench required for the northward continuation would still be necessary. Additional landfill expansion by a second layer of landfill is possible but has not been considered at this time because of the lack of earthen materials to build the levees and ramps.
- b. Cost. \$701,000 for southward expansion in conjunction with northward and eastward continuation (not including permit application). \$117,000 per year of additional landfill life using historical rates of dumping, which includes dumping open to the public, and \$47,000 per year of additional landfill life if use is limited to City of Fort Worth Municipal Departments.
- c. Benefit. Southward expansion adds 6 years of additional life to landfill using historical rates of dumping, which includes dumping open to public, and 15 years if use is limited to City of Fort Worth Municipal Departments. Permits will be required from Texas Department of Health as well as Texas Department of Water Resources.

## 3. Closure of Landfill

- a. Summary. Although it is not considered an option, the possibility of closing the landfill was studied. Ease-



ments would have to be obtained on additionally flooded land and a slurry trench would have to be constructed around levees to prevent water from migration under levees.

- b. Cost. \$1,137,000 (not including permit application)
- c. Benefit. Least costly.
- d. Negative Aspect. It will take valuable landfill out of operation and require possible repairs to erosional damage after flood flows.

In conclusion, because of the present shortage of landfill sites for the City of Fort Worth, we recommend that the landfill be expanded to the south along with the planned landfill continuations to the east and north. This will provide the City with adequate landfill capacity to continue present disposal practices of the Southeast Landfill for 16 years, until 1998. If the City chooses to restrict use of the landfill to Fort Worth Municipal Departments, a life of 39 years, until 2021, is anticipated. It will be necessary to build levees within prescribed limits, channelize Village Creek adjoining the landfill and stop seepage from the present and expanded landfill.

The plans for future landfill operations discussed herein do not include any plans for the landfill property west of Village Creek. It is recommended that the City review their ownership of the area with consideration toward possibly selling the land to help finance the proposed construction.

List of References

- (1) Fort Worth District, U.S. Army Corps of Engineers: "Flood Plain Information, Village Creek, Tarrant and Johnson Counties, Texas," Fort Worth, June 1970.
- (2) Hydrologic Engineering Center, U.S. Army Corps of Engineers: "HEC-2 Water Surface Profiles," Davis, California, August 1979.